Celltech
Testing and Engineering Services Lab

November 19, 2001

Federal Communications Commission
Equipment Approval Services
7435 Oakland Mills Road
Columbia, MD 21046
Attn: Andy Leimer

SUBJECT: **Vertex Standard Co., Ltd.**
FCC ID: K66VXA-150
731 Confirmation No.: EA102553
Correspondence Ref. No.: 21262

Dear Andy:

On behalf of Vertex Standard Co., Ltd. is an amendment in response to items 2 and 3 of your e-mail dated November 15, 2001 requesting additional information for the subject application.

1. Please find attached the revised pages of the SAR test report showing the measured dielectric parameters used for both the head and body SAR tests. Please note that the target tissue parameters for 150MHz were used in the SAR evaluation software. If there was any appreciable variation in the measured tissue parameters from the target values specified then the SAR was adjusted using the sensitivities to SAR (see attached "SAR Sensitivities").
2. The determination of the E-field probe conversion numbers was performed by the system manufacturer's recommended linear extrapolation routine. The extrapolation and interpolation was based on the two calibrated data points of 900 and 1800MHz in head simulating tissue. Included in this response is an example of an identical calibrated E-probe from the same system manufacturer. The conversion numbers outside the two calibration reference points for this probe were determined using numerical methods. There exists at this time no other method by the manufacturer of determining probe conversion below 800MHz. The chart and tables attached indicate the linearity of this E-field probe across several frequency bands with the associated uncertainty. The graph also shows that for frequencies below 800MHz the slope of the derived conversion numbers is steeper. If an extrapolation is performed from the two data points, 900 and 1800MHz, in the absence of numerical modeling, the probe conversion numbers derived are less than those expected. Since the conversion number is inversely proportional to the total SAR value determined, a lower than expected conversion number will result in an over estimation of the actual SAR.

If you have any further questions regarding the above, please do not hesitate to contact me.

Sincerely,

Shawn McMillen
General Manager
Celltech Research Inc.
Testing & Engineering Lab

cc: Vertex Standard Co., Ltd.
M. Flom Associates

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4.0 SAR MEASUREMENT SUMMARY

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum SAR location of the EUT are reported in Appendix A.

Face-Held SAR Measurements

Freq. (MHz)	Channel	Mode	Conducted Power (W)	Antenna Position	Separation Distance (cm)	SAR (w/kg)	
						100% Duty Cycle	50% Duty Cycle
118.000	Low	CW	1.55	Fixed	2.5	0.0753	0.0377
127.500	Mid	CW	1.53	Fixed	2.5	0.917	0.459
136.975	High	CW	1.43	Fixed	2.5	0.134	0.067
Mixture Type: Brain Dielectric Constant: 52.5 Conductivity: 0.75 (measured)			**ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Controlled Exposure/Occupational BRAIN: 8.0 W/kg (averaged over 1 gram)**				

Notes:

1. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure).
2. The highest face-held SAR value found was 0.917 w/kg (100% duty cycle).
3. The EUT was tested for face-held SAR with a 2.5 cm separation distance between the front of the EUT and the outer surface of the planar phantom.
4. Ambient TEMPERATURE: 23.0 °C
   Relative HUMIDITY: 57.4 %
   Atmospheric PRESSURE: 100.4 kPa
5. Fluid Temperature 23.0 °C

Face-held SAR Test Setup
2.5cm Separation Distance

Body-Worn SAR Measurements

Freq. (MHz)	Channel	Mode	Conducted Power (W)	Antenna Position	Belt-Clip Separation Distance (cm)	SAR (w/kg)	
						100% Duty Cycle	50% Duty Cycle
118.000	Low	CW	1.55	Fixed	1.4	3.24	1.62
127.500	Mid	CW	1.53	Fixed	1.4	0.487	0.244
136.975	High	CW	1.43	Fixed	1.4	0.144	0.072
Mixture Type: Body Dielectric Constant: 61.8 Conductivity: 0.79 (measured)			ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Controlled Exposure/Occupational BODY: 8.0 W/kg (averaged over 1 gram)				

Notes:

1. The SAR values found were below the maximum limit of 8.0 w/kg (controlled exposure).
2. The highest body-worn SAR value found was 3.24 w/kg (100% duty cycle).
3. The EUT was tested for body-worn SAR with the attached belt-clip providing a 1.4cm separation distance between the back of the EUT and the outer surface of the planar phantom.
4. Ambient TEMPERATURE: 23.0 °C
   Relative HUMIDITY: 57.4 %
   Atmospheric PRESSURE: 100.4 kPa
5. Fluid Temperature 23.0 °C

Body-worn SAR Test Setup
with 1.4cm Belt-Clip

9.0 SIMULATED TISSUES

The brain and body mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution. Preservation with a bactericide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The fluid was prepared according to standardized procedures and measured for dielectric parameters (permitivity and conductivity).

INGREDIENT	MIXTURE %		
	900MHz Brain (Validation)	**150MHz Brain**	**150MHz Body**
Water	51.07	38.35	46.6
Sugar	47.31	55.5	49.7
Salt	1.15	5.15	2.6
HEC	0.23	1.0	1.0
Bactericide	0.24	0.1	0.1

10.0 TISSUE PARAMETERS

The dielectric parameters of the fluids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an 8753E Network Analyzer. The dielectric parameters of the fluid are as follows:

TISSUE PARAMETERS – DIPOLE VALIDATION & EUT EVALUATION			
Equivalent Tissue (Date: 09/19/01)	**Dielectric Constant e_r**	**Conductivity s (mho/m)**	**r (Kg/m^3)**
900MHz Brain (Target)	41.5 ± 5%	0.97 ± 5%	1000
900MHz Brain (Measured)	41.2 ± 5%	0.96 ± 5%	1000
150MHz Brain (Target)	52.3 ± 5%	0.76 ± 5%	1000
150MHz Brain (Measured)	52.5 ± 5%	0.75 ± 5%	1000
150MHz Body (Target)	61.9 ± 5%	0.80 ± 5%	1000
150MHz Body (Measured)	61.8 ± 5%	0.79 ± 5%	1000

Application Note: SAR Sensitivities

Introduction

The measured SAR-values in homogeneous phantoms depend strongly on the electrical parameters of the liquid. Liquids with exactly matching parameters are difficult to produce; there is always a small error involved in the production or measurement of the liquid parameters. The following sensitivities allow the estimation of the influence of small parameter errors on the measured SAR values. The calculations are based on an approximation formula [1] for the SAR of an electrical dipole near the phantom surface and a adapted plane wave approximation for the penetration depth. The sensitivities are given in percent SAR change per percent change in the controlling parameter:

$$S(x) = \frac{d\ SAR / SAR}{d\ x / x}$$

The controlling parameters x are:

- ε : permitivity
- σ : conductivity
- ρ : brain density (= one over integration volume)

For example: If The liquid permitivity increases by 2 percent and the sensitivity of the SAR to permitivity is -0.6 then the SAR will decrease by 1.2 percent.

The sensitivities are given for surface SAR values and averaged SAR values for 1 g and 10 g cubes and for dipole distances d of 10mm (for frequencies below 1000 MHz) and 15mm (for frequencies above 1000 MHz) from the liquid surface.

Liquid parameters are as proposed in the new standards (e.g., IEEE 1528).

References

[1] N. Kuster and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300 MHz", *IEEE Transacions on Vehicular Technology*, vol. 41(1), pp. 17-23, 1992.

Parameter		ε	σ	ρ
f=300 MHz (εr=45.3, σ=0.87S/m, ρ=1g/cm³)				
d=15mm:	**Surface**	- 0.41	+ 0.48	—
	1 g	- 0.33	+ 0.28	0.08
	10 g	- 0.26	+ 0.09	0.16
f=450 MHz (εr=43.5, σ=0.87S/m, ρ=1g/cm³)				
d=15mm:	**Surface**	- 0.56	+ 0.67	—
	1 g	- 0.46	+ 0.43	0.09
	10 g	- 0.37	+ 0.22	0.17
f=835 MHz (εr=41.5, σ=0.90S/m, ρ=1g/cm³)				
d=15mm:	**Surface**	- 0.70	+ 0.86	—
	1 g	- 0.57	+ 0.59	0.10
	10 g	- 0.45	+ 0.35	0.18
f=900 MHz (εr=41.5, σ=0.97S/m, ρ=1g/cm³)				
d=15mm:	**Surface**	- 0.69	+ 0.86	—
	1 g	- 0.55	+ 0.57	0.10
	10 g	- 0.44	+ 0.32	0.19
f=1450 MHz (εr=40.5, σ=1.20/m, ρ=1g/cm³)				
d=10mm:	**Surface**	- 0.73	+ 0.91	—
	1 g	- 0.55	+ 0.55	0.12
	10 g	- 0.42	+ 0.27	0.22
f=1800 MHz (εr=40.0, σ=1.40S/m, ρ=1g/cm³)				
d=10mm:	**Surface**	- 0.73	+ 0.92	—
	1 g	- 0.52	+ 0.51	0.14
	10 g	- 0.38	+ 0.21	0.24
f=1900 MHz (εr=40.0, σ=1.40S/m, ρ=1g/cm³)				
d=10mm:	**Surface**	- 0.73	+ 0.93	—
	1 g	- 0.53	+ 0.51	0.14
	10 g	- 0.39	+ 0.22	0.24
f=2000 MHz (εr=40.0, σ=1.40S/m, ρ=1g/cm³)				
d=10mm:	**Surface**	- 0.74	+ 0.94	—
	1 g	- 0.53	+ 0.52	0.14
	10 g	- 0.39	+ 0.22	0.24
f=2450 MHz (εr=39.2, σ=1.80S/m, ρ=1g/cm³)				
d=10mm:	**Surface**	- 0.74	+ 0.93	—
	1 g	- 0.49	+ 0.41	0.17
	10 g	- 0.34	+ 0.12	0.28
f=3000 MHz (εr=38.5, σ=2.40S/m, ρ=1g/cm³)				
d=10mm:	**Surface**	- 0.75	+ 0.90	—
	1 g	- 0.45	+ 0.28	0.21
	10 g	- 0.32	+ 0.02	0.31

EXAMPLE

Dosimetric E-Field Probe ET3DV6
Head Tissue Conversion Factor (± standard deviation)

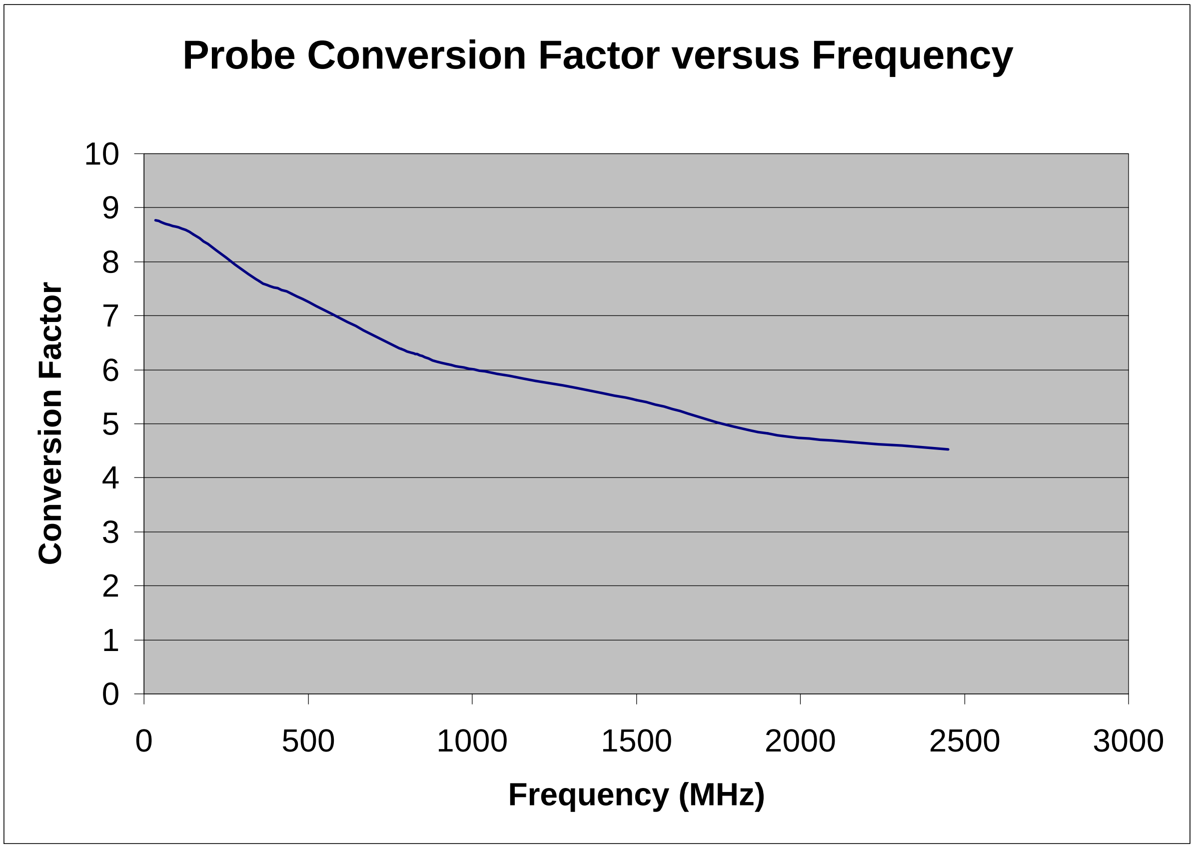
400 MHz	ConvF	7.64 ± 8%	ε_r = 44.4 σ = 0.87 mho/m CENELEC Head Tissue
835 MHz	ConvF	6.54 ± 8%	ε_r = 42.5 σ = 0.98 mho/m CENELEC Head Tissue
900 MHz	ConvF	6.41 ± 8%	ε_r = 42.3 σ = 0.99 mho/m CENELEC Head Tissue
350 MHz	ConvF	7.76 ± 8%	ε_r = 44.7 σ = 0.87 mho/m IEEE Head Tissue
450 MHz	ConvF	7.52 ± 8%	ε_r = 43.5 σ = 0.87 mho/m IEEE Head Tissue
835 MHz	ConvF	6.53 ± 8%	ε_r = 41.5 σ = 0.90 mho/m IEEE Head Tissue
925 MHz	ConvF	6.37 ± 8%	ε_r = 41.45 σ = 0.98 mho/m IEEE Head Tissue
1500 MHz	ConvF	6.04 ± 8%	ε_r = 40.43 σ = 1.23 mho/m IEEE Head Tissue
1900 MHz	ConvF	5.41 ± 8%	ε_r = 40.0 σ = 1.40 mho/m IEEE Head Tissue
2450 MHz	ConvF	5.18 ± 8%	ε_r = 39.2 σ = 1.8 mho/m IEEE Head Tissue
2450 MHz	ConvF	5.40 ± 8%	ε_r = 37.2 σ = 2.09 mho/m H1800 at 2450 MHz

Dosimetric E-Field Probe ET3DV6 \ **EXAMPLE**

Body Tissue Conversion Factor (± standard deviation)

Frequency		ConvF	Tissue parameters
35 MHz	ConvF	8.77 ± 15%	ε_r = 85.19 σ = 0.69 mho/m FCC Body Tissue
75 MHz	ConvF	8.68 ± 10%	ε_r = 69.93 σ = 0.72 mho/m FCC Body Tissue
150 MHz	ConvF	8.51 ± 8%	ε_r = 62.68 σ = 0.75 mho/m FCC Body Tissue
350 MHz	ConvF	7.64 ± 8%	ε_r = 58.41 σ = 0.80 mho/m FCC Body Tissue
450 MHz	ConvF	7.40 ± 8%	ε_r = 57.62 σ = 0.83 mho/m FCC Body Tissue
784 MHz	ConvF	6.38 ± 8%	ε_r = 56.25 σ = 0.93 mho/m FCC Body Tissue
835 MHz	ConvF	6.28 ± 8%	ε_r = 56.11 σ = 0.95 mho/m FCC Body Tissue
925 MHz	ConvF	6.10 ± 8%	ε_r = 55.9 σ = 0.98 mho/m FCC Body Tissue
1500 MHz	ConvF	5.44 ± 8%	ε_r = 54.87 σ = 1.23 mho/m FCC Body Tissue
1900 MHz	ConvF	4.82 ± 8%	ε_r = 54.3 σ = 1.45 mho/m FCC Body Tissue
2450 MHz	ConvF	4.53 ± 8%	ε_r = 53.57 σ = 1.81 mho/m FCC Body Tissue

EXAMPLE



Probe Conversion Factor versus Frequency
Conversion Factor
0
1
2
3
4
5
6
7
8
9
10
0
500
1000
1500
2000
2500
3000
Frequency (MHz)